

Claims

1. Apparatus for the measurement of physical and/or chemical quantities using

- ☐ a light source (122) and a light guide (124) to couple the light of the light source (122) in an optical resonator (12) shaped as microparticle,
- ☐ and means (128) for the observation of the light decoupled from the resonator (12),

characterized in that

- ☐ the resonator (12) is at least partly mounted in a cutout (18) formed in the light guide (124) and fixed there mechanically and coupled optically to the light guide (124).

2. Apparatus according to claim 1, wherein

- ☐ the cutout (18) is formed on a free end of the light guide (124) having an opening to the front side (20) of the light guide (124).

3. Apparatus according to one of the preceding claims, wherein

☐ the light guide (124) is a hollow waveguide (34, 44).

4. Apparatus according to claim 3, wherein

☐ the hollow waveguide (34, 44) has at least on a first place a larger inner diameter than on a second place. The first place is close to the free end; the second place is farther from the free end.

5. Apparatus according to one of the preceding claims, wherein

☐ only one light guide (124) is present,

☐ where in the light guide (124) light propagates in a first propagation direction from the light source (122) to the resonator (12) and back from the resonator (12) in a second opposite propagation direction.

6. Apparatus according to one of the preceding claims, wherein

☐ the resonator (12) contacts the light guide (124) on at least two locations - separated by a distance - and is held there by clamping.

7. Apparatus according to one of the preceding claims 1 to 5, wherein

- ☐ the resonator (12) is positioned on the light guide (124) in a way that a gap remains between the resonator (12) and a light guiding part (34) of the light guide.

8. Apparatus according to one of the preceding claims, wherein

- ☐ the light guide (124) is tapered on its free end.

9. Apparatus according to one of the preceding claims, wherein

- ☐ the light guide (124) is covered on its free end by a cap (82) or closed by a sealing compound (92).

10. Apparatus according to one of the preceding claims, wherein

- ☐ the light guide (124) has at least one lengthwise slit (52, 62) on its end.

11. Apparatus to measure physical and/or chemical quantities by a

- ☐ light source (192) and several light guides (194, 195) to couple light from the light source (192) in a resonator (12) shaped as a microparticle,

- ☐ and means (198) to observe light decoupled from the resonator (12),

characterized in that

- ☐ the resonator (12) is placed in the front part of a wedge-shaped sensing tip (132) with two converging bars (134a, 134b),
- ☐ where the bars (133a, 133b) or parts it consist of light transmitting material and are coupled to two light guides (194, 195) on the rear end of the measuring tip (132). A first of said light guides (194, 195) is connected to the light source (192) and a second light guide (194, 195) is connected to the evaluation tool (198).

12. Apparatus according to claim 11, wherein

- ☐ the rear part of the measuring tip (132) has a socket (131, 150) with openings (142a, 142b, 152a, 152b) to accept the light guides (194, 195),
- ☐ where said light guides (194, 195) are fitted in the openings (142a, 142b, 152a, 152b) and optically coupled to the light guiding material of the bars (133a, 133b).

13. Apparatus according to claim 11 and 12, wherein
- ☐ the sensing tip (132) has a ground plate (135) and/or a cover plate (136).
14. Apparatus according to claim 13, wherein
- ☐ the cover plate (136).and/or the ground plate (135) has one or several lengthwise slits (138) at least in the front part.
15. Apparatus according to claim 13 or 14, wherein
- ☐ the cover plate (136).and/or the ground plate (135) has one lengthwise guide groove (160, 180) at least in the front part.
16. Apparatus according to one of the preceding claims, wherein
- ☐ several resonators (12a, 12b, 12c, 12d, 12e) are present
 - ☐ said resonators (12a, 12b, 12c, 12d, 12e) are coupled to the same light guide (102, 112) or to the same light guides (194, 195).
17. Apparatus according to claim 16, wherein

- ☐ the resonators (12a, 12b, 12c, 12d, 12e) are made in a way, that their particular optical resonances are excited by light with different frequencies.

18. Apparatus according to one of the preceding claims, wherein

- ☐ the resonator or the resonators (12, 12a, 12b, 12c, 12d, 12e) are shaped spherically or as ellipsoids.

19. Apparatus according to one of the preceding claims, wherein

- ☐ the light source (122, 192) is addressable to generate light with different wavelengths,
- ☐ and the evaluation devices (128, 198) measure the intensity of the light decoupled from the resonator (12).

20. Apparatus according to one of the claims 1-18, wherein

- ☐ the light source (122, 192) emits broadband light
- ☐ and the evaluation devices (128, 198) measure the intensity of the light decoupled from the resonator (12) frequency dependent.

21. Apparatus according to claim 20, wherein

- the material of the resonator (12) is excited to fluorescence.